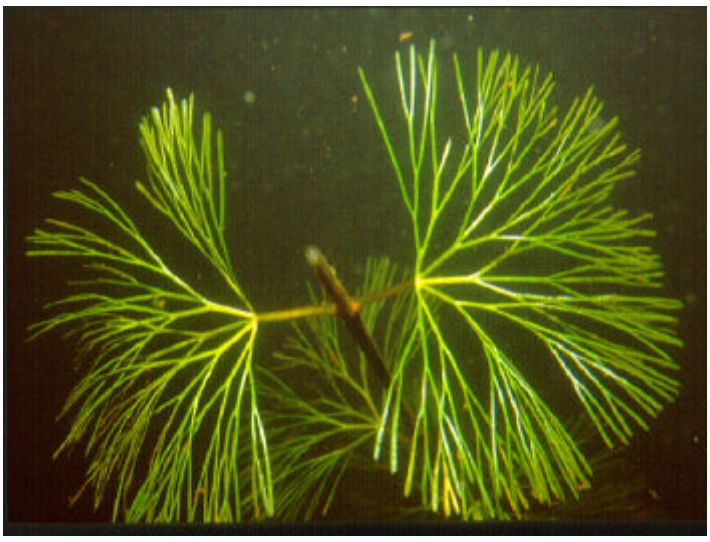
Lake Macdonald Catchment Care Group

Environmental Recovery Plan April 2002

Cabomba control by mechanical harvesting and habitat restoration using native water grasses.



Natural Heritage Trust

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Natural Resources and Mines

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Index

1.0 Purpose:

A plan to control cabomba by mechanical harvesting and habitat restoration using native submerged water grasses. This document provides guidance and methodology. It also records some of the lakes natural history.

1.1 Project code:

Commonwealth identification codes:
34505. Strategic Cabomba Control by Community Action
34506. Aquatic Habitat Restoration after cabomba control.

1.2 Cabomba:

Cabomba is an American submerged plant. It is recognised as a weed of national significance across Australia. A declared pest plant in QLD, NSW, WA and NT because it:

- Degrades potable water quality,
- Is a public safety risk, and
- Destroys nature conservation values.

Botanical name	*Cabomba caroliniana* var. Carolina A. Gray.
Family	Cabombaceae (Otgaard 1991)
Order	Nymphaeales

1.3 Native Water Grasses:

Prior to the invasion of Lake Macdonald by cabomba, the lake bed had a thriving underwater community of native grasses made up of:

1. Botanical name.	*Hydrilla verticillata* (L.f.) Royle
Family.	Hydrocharitaceae
2. Botanical name.	*Vallisneria nana* L.
Family.	Hydrocharitaceae
3. Botanical name.	*Najas tenuifolia* R.Br.
Family	Najadaceae.
4. Botanical name.	*Potamogeton crispus* L.
Family	Potamogetonaceae

Native water plants provide feeding, breeding, nursery and protection sites for all water creatures as well as playing a big role in keeping pollution under control.

1.4 Aims:

- Control over 100 ha of cabomba in selected priority areas.
- Revegetate 100 ha of Lake Macdonald with native aquatic grasses.
- Enhance native habitat.
- Improve the visual amenity of the lake.

1.5 Objectives:

- Evaluate mechanical harvesting regimes.
- Establish a native aquatic grass nursery.
- Develop long term, natural control of cabomba by re-establishing competitive native aquatic grasses.
- Develop technology and principles regarding culture of aquatic native grasses.
- Improve the quality of recreational experiences offered on the lake.

1.6 Funding:

Total budget is $867,000 .

Funding source	**Year $**		
	Jan-June 2001	**June-July 2001**	**June-Dec2002**
Commonwealth Gov't. Natural Heritage Trust	0	118,000	56,600
State Gov't. Natural Resources & Mines	17,500	32,000	16,000
Local Gov't. Noosa Council	51,800	428,000	61,500
Lake Macdonald Catchment Care Group	7,900	50,800	25,400

1.7 Principles underpinning the plan:

- Community driven plan.
- Resources directed to where most is to be gained with the best chance of success.
- Long term natural control methods.
- Integrated weed management.

Relationships with other plans:

This plan reinforces the:

- National Weeds Strategy.
- South East Queensland Environmental Weeds Strategy
- Noosa Council's Pest Management Plan

2.0 Harvesting Regimes:

Experience has shown that cabomba regrowth after harvesting does not follow a consistent pattern. The effect of season, temperature, wind and flood influence cabomba response to cutting. To overcome this the harvesting regimes are based on cabomba growth rate rather than a time period.

The plan studies 2 harvesting regimes.

1. To **cut the cabomba on a regular, relentless basis**. (That will never allow the cabomba to reach the surface.) Green areas on Map 1 and table1.

2. To **cut the cabomba at a lower intensity**. (The plants are allowed to reach the surface before being harvested.) Yellow areas on Map1 and Table 1.

3. Control areas .(This area will not be harvested, a control provides comparative data on cabomba growth.) Red areas on Map1 nad Table1.

4. Areas of the dam not under experimentation (blue areas in maps 1&2) will be harvested on an as required basis. This will reduce plant biomass, and consequently minimise weed out flow into Six Mile Creek.

Sites locations are set out in Table 1 and Map1.

Council's Weed Supervisor and researchers are to work closely with the harvester operator. The operator should also be involved with future research.

It is suggested that an additional harvester operator be selected and trained to maximise use of the harvester.

2.1 Regeneration with native grasses.

Lake Macdonald prior to invasion of cabomba had a thriving submerged plant community consisting of mainly grasses such as

- *Hydrilla verticillata*
- *Vallisneria nana*
- *Potamogeton spp*
- *Najas tenuifolia.*

Of these species, Hydrilla and Vallisneria are the most hardy. Mechanical harvesting will remove the cabomba canopy allowing sunlight to penetrate the water column and provide opportunities for revegetating the lake.
The recovery plan depends on continued cabomba harvesting before and after the native grasses have been planted.

Nursery
A suitable site has been selected near the Noosa and District Landcare Nursery in Pomona.

- Ground preparation will consist of 150 mm of gravel base.
- Growing ponds will be set up for the propagation of hydrilla and vallisneria.
- Ponds will probably be made of heavy timber and thick PVC sheeting.

All plant material will be collected from the Six Mile Creek system under an appropriate permit. Care will be taken to ensure wild native plant populations are not damaged in the process.

3.0 Scientific studies by Gabrielle Viviansmith

Research will be carried out with an appreciation of wider issues such as, landscape aesthetics, wildlife needs and public expectations.

Assessments will be made of:

- Biodiversity. Different species of flora and fauna present. Population sizes and structure, % survival of native plants.
- Habitat integrity. Assess vegetation strata and health eg canopy condition, seedling establishment, plant growth, runner length, cabomba tolerance to native plants.
- Long term sustainability. Overall interactions between biodiversity, habitat integrity and external landscape processes. Influence of ongoing harvester operations, cabomba resilience and nutrient impacts.

Methodology used will be:

- Monthly scuba diving inspections will be made along permanent 50 m transects that have been set up at 20 locations around the lake foreshore. See Map 2, Table 2.
- Plant biomass and species composition will be done using diver collected $1m^2$ quadrats. Notes will be made of plant weight, plant number, plant length, % flower, % leaf and root mass.
- Records will be kept of water appearance, secchi disc, water clarity, wave height, temperature and dissolved oxygen.

Analysis will focus on biomass changes in cabomba over time and with treatment. Regular progress reports will be made to the monthly meetings of the catchment care group providing guidance and flexibility to future harvesting management decisions.

3.1 Research question 1. Do harvesting regimes reduce cabomba's capacity to dominate?

This would involve a comparison of baseline data (before harvesting) gathered from transects and after harvesting regimes have been implemented at similar times of the year.

Capacity to dominate can be measured by:

1. Plant biomass (wet plant weight)/ m^2.
2. Plant length.
3. Diversity (number of native species / m^2., biomass of native species/ m^2).
4. Buoyancy, specific gravity.
5. Plant health (epiphyte load, colour, strength).
6. Water quality (clarity, algal blooms etc).

Some environmental variables and /or possible covariates.

1. Water depth
2. Sediment type

Research question 2. Do harvesting regimes influence revegetation success?

The effect of harvesting regimes upon the success of the revegetation program can be determined by comparing measures of revegetation success from different harvesting regimes (control, intensity 1 and 2).

Revegetation success can be measured by:

1. Increased abundance (biomass or wet plant weight/ m^2) of native species (total and relative to cabomba biomass).
2. Improved diversity of native plant species / m^2
3. Reduction in cabomba abundance (area covered and biomass / m^2).
4. Improved ecosystem function (water quality, macro invertebrate diversity, fish and bird populations.)
5. Frequency of harvesting.
6. Longer-term increased cover (areal expansion) of native species (mapping approach).

Some environmental variables and /or possible covariates.

3. Water depth (revegetation success may be dependent on water depth)

4. Sediment type (texture, pH, N, P, organic mater).

Experimental design.
A single factor Analysis of variance design with blocking will be used to test questions1 and 2. Harvesting intensity would be the factor or treatment tested, with the spatial locations of sampling transects representing the blocking factror (2 blocks). Design could be 3 harvesting intensity treatments × 2 blocks × 3 replicates per block Total of 18 transects).

Allocation of treatments and sites.

Treatment	**Block (location)**	**Transect number**	**Map grid ref.**
1, intense	1	T1, T4, T11	A1, A4, E2
	2	T13, T14, T15	J13, I13, H12
2, low	1	T7, T8, T9	C3, C4, D3
	2	T18, T22, T24	I12, G12, H12
3, control	1	T17, T19, T20	F2, F7, D5
	2	T16, T21, T23	I9, J12, I10

- Block 1 is Lake Macdonald Dr, and block 2 is Hayward Rd.

Research question 3. Are some revegetation strategies more successful than others?
There are multiple approaches that could be taken here, but given the current pioneering stage of aquatic revegetation and limitations on experimental design complexity, a very simple approach is suggested.

If different revegetation strategies are to be compared, then some questions that could be investigated are:
- Whether planting's should be in patches of single species or 3 species mixtures?
- Whether a single planting or repeated planting's should be used?
- Will planting density improve revegetation success and have any impact upon cabomba?

Density is one of the most fundamental factors affecting revegetation success and cost of revegetation therefore represents a priority strategy to test.

The competitive nature of cabomba and the range of aquatic habitats present (due to the depth gradient), means that both follow up planting and a mixed species approach, will be best bet options for revegetation success, making the other revegetation strategy questions posed above of secondary importance.
Any relationships to individual species success and other factors (eg. Water depth or harvesting regime) could be extracted from the data collected.

This could be done by a simple experimental design that investigates the effect of harvesting regime and planting density upon revegetation success. This should also illuminate any interaction between the revegetation strategies (eg. Planting density) and harvesting intensity treatments.

Revegetation Timing

- Follow-up planting of one or more species should be considered.
- Aim for when cabomba growth is slowest relative to native species growth.
- Given the limited timeframe of the project there may not be much flexibility in timing of the plantings.
- Should aim to do plantings in research areas in a compressed time period (to enable valid comparisons of treatments). Other areas could be revegetated with a more relaxed timeframe.

Design

Some questions need to be addressed before deciding on the planting design (spatial location of plants).

- What will be the planting density per m^2.
- How many plants will be propagated?
- How much area can be revegetated.
- If different density treatments are to be used how will these be set out (experimental design considerations).
- Where will be the planting take place (presumably along transect lines allocated to revegetation treatments)?

Experimental design.

Using the existing harvesting program and field experience, planting density and which species could be tested for revegetation success. A balanced factorial design could be set out in the intensely harvested areas. Two species hydrilla and vallisneria would be one factor, while planting density high and low would be the other . 2 species× 2 densities× 3 replications.

Treatment allocation.

Species	**Planting density**	**Replication sites**
Hydrilla	High	T1, T15, T25
	Low	T2, T6, T26
Vallisneria	High	T3, T5, T27
	Low	T4, T14, T28

3.2 Constraints.

Research activities are no different to the rest of the environmental plan. They depend on favourable weather conditions, ongoing funding, resource allocation and public support for a positive outcome.

3.3 Review:

The Lake Macdonald Catchment Care Group is the reviewing body responsible for monitoring the plans progress, addressing problems and updating improvements to the plan over time.

3.4 Copy right:

4.0 Fish Species in Lake Macdonald by Gerry Cook

Species endemic to the Lake

Gudgeons	-	*Hypseleotris* spp. *Phylipnodon* sp. *Mogurnda adspersa*
Sunfish		*Melanotaenia douboulayi*
Hardyhead	-	*Craterocephalus stercusmuscarum*
Smelt	-	*Retropinna semoni*
Blue eye		*Pseudomugil signifer*
Eels	-	*Anguilla reinhardti* *Anguilla australis*
Catfish	-	*Tandanus tandanus* *Neosilurus hyrtlii*
Olive perchlet	-	*Ambassis agassizii*
Spangled perch	-	*Leiopotherapon unicolour*
Bony bream	-	*Nematolosa erebi*
Cod	-	*Maccullochella peelii mariensis*

Notes

Most of the above species breed regularly in the lake and/or its catchment. Both species of eel return to the sea to breed and the elvers make their way upstream during floods, climbing the spillway with ease.
Little is known about *Neosilurus hyrtlii*. It is abundant in Six Mile Creek as far up as the spillway, although it is seldom seen. It is not known if it is breeding in the lake. The spangled perch was abundant in the lake and catchment up to about 1985, and was clearly breeding there. Although still abundant at times below the spillway, it appears now to be absent from the lake.
The bony bream has always been present as far up as the spillway, but not known to be present in the lake. Reports now suggest that it may be breeding there. It is a good forage fish for the cod. It has never appeared in dense populations in the Mary system, preferring the more nutrient rich waters further west.

4.1 The Mary river cod.

This fish is one of four closely related species. Two live in the Murray/Darling system, and two in eastern coastal streams from the Clarence to the Mary. In recent years, those in the streams between these two rivers have all become extinct, and their taxonomy will never be known. The two remaining species, one in the Clarence, and one in the Mary are now protected.

The cod is a large long-lived predator, which deposits adhesive eggs in such protected situations as hollow logs. Spawning occurs when water temperatures rise to 20C and normally occurs only once per year. The male guards the eggs and also the larvae until they disperse to seek their first food. The eggs take about 4 days start hatching, and the larvae take a further 10 days to absorb the yolk sac before moving away to feed. Those few that survive reach maturity at about five years of age, at which time they average about 2kg in weight. The male defends the eggs and larvae very aggressively. Maximum size is considered to be about 20kg, but the late Mr. Jack Conway, fishing with his brother in Wide Bay Creek in the 1920's, recorded one of **63lbs.**
Principal food consists of crustaceans, particularly crayfish, but almost anything that moves, including fish, mammals, reptiles and birds are taken when available. It is a popular sporting and edible species.

The cod was once plentiful throughout the catchment, but disappeared soon after the dam was built. Sadly, we have no evidence of breeding there. Indeed there is a lack of evidence of natural recruitment anywhere in the Mary catchment.

Cod fingerlings have been stocked into Lake Macdonald annually since 1983, and have matured there and spread downstream in significant numbers, at least as far as Gympie.

THERE IS NO EVIDENCE OF BREEDING AND RECRUITMENT IN OR ABOVE THE LAKE.

4.2 Introduced species

Mosquito fish	-	*Gambusia holbrooki*
Saratoga	-	*Schleropages leichardti*
Golden perch	-	*Macquaria ambigua*
Silver perch	-	*Bidyanus bidyanus*
Bass	-	*Percolates colonorum*

Notes

Of the above, only the Saratoga and the pest Mosquito fish are known to breed in the lake. Various species of mullet are common below the spillway, but return to the sea to breed. This fish is now the subject of hatchery breeding in Gladstone and may become popular for lake stocking.

5.0 Birds of Lake Macdonald by Valda McLean

A large, open, permanent expanse of water such as Lake MacDonald is an ideal habitat for many water birds. The surrounding bush and gardens provide food and shelter for a diverse range of bush birds.

Of the 77 species recently recorded around the lake, 25 species directly depend on the water and its environs for food and shelter. Whilst magpie Goose and Whistling-Duck are regular visitors, the majority of the recorded water birds are resident species.

Birds such as Darter, which hunt under water, Hardhead which dives freely, Australasian Grebe, reported to dive to 3 metres, or Eurasian Coot diving to more than 7 metres for aquatic vegetation, would be impeded by a dense mass of Cabomba weed. To date observers have no evidence of birds tangled in the weed. Resident birds appear to accept the presence of the Cabomba weed harvester on the lake. Whiskered Tern is one species that has been previously reported in numbers, but not recorded during recent surveys. The presence of Cabomba weed may have affected the Tern's feeding technique of plunging to the water surface from approximately 10 metres, to take small aquatic creatures.

Breeding pairs of Australasian Grebe and Comb-crested Jacana both construct floating platforms of vegetation on which to lay eggs. The platform is anchored to reeds or waterlilies growing from the bottom of the lake. The nest of the Black Swan is a heap of vegetation piled up in shallow water. Crakes, Rails, Coot, Swamphen etc. (family *Rallidae*) generally nest in secluded verges using reeds and swampy vegetation. Lake MacDonald appears to be an ideal breeding area for Nankeen Night Heron, as we are seeing more of the birds, although nest sites have not been found. Observers have no record of birds specifically using the Cabomba weed, either for food or nest building.

Locals and visiting bird observers are always delighted to see the rare Black-necked Stork, 'Jabiru', striding through the water or running after fish or eels. Cotton Pygmy-goose, described as 'a rare and beautiful bird', is another welcome sight. This species feeds mainly on seeds, seed heads and aquatic plants.

Breeding and feeding behaviour of many Australian bird species is yet to be studied.

An indication of the diversity of bird life on the lake can be seen in table 3, where sightings were recorded by 10 birdwatchers
(John, Meg, Robert, Shirley, Mary, Ron, Valdamay, Denis, Mike, and Valda) on the 20th July 2001. Weather conditions were fine, cool, and calm with 70% cloud cover.
The group surveyed 3 areas, starting at the spillway, Lake MacDonald Drive at 8.30 am. We moved to Grange Road where the weed harvester was working and the diesel truck running continuously. After a morning tea break we moved to a spot off Gumboil Road, finishing at midday.

We were surprised to see so few ducks.
Australasian Grebe and Comb-crested Jacana were present in good numbers, obviously accepting the presence of the weed machine.
Glossy Ibis is a welcome but uncommon visitor. Their presence is an indication that water levels are low.

One raptor, possibly a dark phase of the Brown Falcon was not positively identified.

Table 3. Results of Bird Survey 20th July 2001

Sighting	Bird species	Number Seen	Sighting	Bird species	Number Seen
1	Magpie Goose	9	40	Pale-headed Rosella	1
2	Black Swan	1	41	Fan-tailed Cuckoo	1
3	Australian Wood Duck		42	Shining Bronze-Cuckoo heard	1
4	Pacific Black Duck	6	43	Laughing Kookaburra	1
5	Grey Teal	1	44	Forest Kingfisher	2
6	Chestnut Teal	1	45	Variegated Fairy Wren	4
7	Hardhead	1	46	Striated Paralote heard	2
8	Australasian Grebe	46	47	White-browed Scrub wren	2
9	Darter	2	48	Large–billed Scrub wren	2
10	Little, pied cormorant	22	49	White-throated Gerygone heard	1
11	Little Black Cormorant	17	50	Brown Thornbill	1
12	Great Cormorant	2	51	Little Wattlebird	4
13	Australian Pelican	1	52	Noisy-Friarbird heard	1
14	White-faced Heron	3	53	Blue-faced Honeyeater	1
15	White-necked Heron	1	54	Noisy Miner	2
16	Great Egret	1	55	Lewin's Honeyeater	4
17	Intermediate Egret	2	56	Yellow-faced Honeyeater	2
18	Cattle Egret	5	57	White-throated Honeyeater	3
19	Glossy Ibis	5	58	Brown Honeyeater	4
20	Australian White Ibis	2	59	Scarlet Honeyeater	5
21	Royal Spoonbill	7	60	Eastern-Yellow Robin	1
22	Black-necked Stork *	1	61	Eastern Whipbird heard	2
23	Pacific Baza heard	1	62	Olden Whistler	2
24	Whistling Kite	4	63	Grey Shrike-thrush heard	1
25	Purple Swamp hen	42	64	Magpie-lark	5
26	Dusky Moor hen	19	65	Rufous Fantail	1
27	Eurasian Coote	40	66	Grey Fantail	6
28	Comb-crested Jacana	13	67	Willie Wagtail	1
29	Black-winged Stilt	1	68	Black-faced Cuckoo-shrike	7
30	Masked Lapwing	2	69	Figbird	4
31	White-headed Pigeon	2	70	Grey Butcherbird	3
32	Spotted Turtle-Dove	1	71	Pied Butcherbird heard	1
33	Crested Pigeon	2	72	Australian Magpie	4
34	Bar-shouldered Dove	3	73	Pied Currawong	1

35	Yellow-tailed Black-Cockatoo heard	1	74	Torresian Crow	6
36	Galah	4	75	Welcome Swallow	5
37	Sulphur-crested Cockatoo	7	76	Tree Martin	5
38	Rainbow Lorikeet	2	77	Golden-headed Cisticola	3
39	Australian King Parrot	1			

*Female bird caught and ate approx. 400 mm Catfish

Table 4. Bird species, status and biology.

Bird	Resident/	Food	Breeds	Nests
Magpie Goose	Visits	Aquatic veg.	July/ Nov/a rain	Sedge Plat.
Wandering Whistling-duck	Visits	Aquatic veg.	Jan/May	Ground scrape
Black Swan	Resident	Aquatic veg.	April/Oct/a rain	Pile veg.
Australian Wood Duck	Resident	Grazes	After rain	Tree/grasses
Cotton Pygmy-goose	Resident/	Aq.seeds/ins	Nov/April	Tree hollow
Pacific Black Duck	Resident	Plants /seeds	June/Dec	Stump or tree
Hardhead	Resident	Plants/insect	Aug/Dec	Reeds
Australasian Grebe	Resident	Insects feath	Aug/Dec	Floating plat.
Darter	Resident	Fish	Spring /Autumn	Tree o water
Little Pied Cormorant	Resident	Fish	Any Month	Tree o water
Little Black Cormorant	Resident	Fish	Any month	Tree o water
Great Cormorant	Resident	Fish	Any Month	Tree o water
Australian Pelican	NonBr. R	Fish	Any month	Not here
White-faced Heron	Resident	Insects /fish	Sept/Nov	Tree
Little Egret	Resident	Fish/insects	Oct/Feb	Tree o water
Great Egret	Resident	Fish/insects	Nov/Feb	Tree o water
Intermediate Egret	Resident	Fish/insects	Nov/Jan	Tree o water
Nankeen Night Heron	Resident	Fish/insects	Sept/Feb	Tree o water
Royal Spoonbill	Resident	Fish	Sept/ Nov	Tree o water
Black-necked Stork	Visits/R	Fish	Oct/May	High tree
Buff-banded Rail	Pos.res	Insects/seeds	Sept/March	Reeds
Purple Swamphen	Resident	Frogs/veg.etc	July/Dec mainly	Reeds
Dusky Moorhen	Resident	Veg.frogs,ins	August/March	Reeds
Eurasian Coot	Resident	Vegetation	August/Feb	Lo stump, log
Comb-crested Jacana	Resident	Plants insect	Sept/May	Veg. platform
Azure Kingfisher	Resident	Fish/insects	Sept/Jan	Tunnel bank

6.0 Background reading:

The Lake Macdonald Catchment Care Group (LMCCG) was formed in April 1999. The main foundation issue was and still is the cabomba weed problem in Lake Macdonald. The group acts as a community clearing house, coordinating research and its implementation and finally promoting community action.

Lake Macdonald is in a regionally strategic and critical location at the headwaters of the 309km Mary River system, a waterway serving the community needs of the Shires of Noosa, Maroochy, Gympie, Tiaro and Maryborough.

Lake Macdonald and its tributaries is habitat for priority endangered species such as Mary River Cod (the lake forms one of the major nursery sites for stocked fingerlings) and Purple

Spotted Gudgeon Fish. The Mary River Turtle (*Elusor macrurus*)and an as yet undescribed species of *Elseya* turtle have a native range downstream. The habitat alterations caused by the prolific growth of cabomba posses a significant risk to the populations of these species and may be considered as a 'threatening process'.

During 1999 the LMCCG carried out a pilot study into the efficacy of removing the cabomba infestation using a mechanical harvester, highlighting the environmental impacts caused by cabomba and the benefits of its removal. When cabomba was removed, dissolved oxygen levels improved, water nutrients (nitrogen and phosphorus) were reduced by 25%; and significant amounts of pollution were removed (1,500 kg nitrogen, 122 kg phosphorus, 380 kg manganese, 9.4 g mercury and 216 g lead were removed from the lake in 19 days).

Mechanical control targets a weakness in the plants survival biology. Cabomba has no rhizomes, stolons, tubers, turions or seed. It's only method of spread is meristem fragments, especially the stem tip which is designed to survive hardship and travel on water currents.

The harvester removes the plant canopy, including the stem tips at the water surface, thus reducing potential spread downstream. Also the vigour of the plant is weakened. It is intended to reduce the standing crop of the cabomba from approximately 75 tonnes/ha to 20-25 tonnes/ha. It has been determined that repeated removal of this amount of material severely weakens the plants and threatens their survival.

After 6 years of intense research by LMCCG, no native underwater plants have been found in Lake Macdonald. Cabomba has established a virtual monoculture. Competitive shading and allelopathic activity by the cabomba infestation has completely destroyed the submerged native plant community, which has in turn seriously influenced the aquatic fauna.

Cabomba is a herb forming a dense canopy at the water surface. Native submerged grasses form dense savannah grassland at the bottom of the lake. The control of cabomba removes the canopy allowing more light to enter, thus promoting regeneration of the aquatic grasses. Areas that were harvested twice during the 2000 pilot study only recorded two remnant native Hydrilla plants surviving beneath the cabomba canopy. The growth habit of cabomba compared to the native aquatic grasses can be exploited to favour the regeneration of these grasses.

The project will actively involve the wider community. School groups, catchment management and Waterwatch members can take part in planting the propagated native water plants, thus directly helping to restore the natural balance of the lakes ecosystems.

At the commencement of the project, an aquaculture nursery area will be set up to grow Hydrilla, Vallisneria and Najas aquatic grass species. This involves establishing 6 above ground pools through which water is circulated via a pump system. The native grasses are field collected from within the Six Mile Creek system to provide initial propagating material, and from then are propagated in the man made pools

After areas of cabomba have been harvested, they will be assessed for their revegetation potential. When it is established that the area is suitable for revegetation, plants will be taken from the pools and prepared for planting. This will involve wrapping the roots with some substrate from the pools in a degradable material and dropping these 'packages' from the aluminium boat. The plants will descend and lodge on the bottom, where it has been established that they will quickly take root and colonise the lake bed.
Longer-term maintenance of the operation will be undertaken by the LMCCG (with the assistance of Noosa Shire Council), once the project has been completed. The project will develop successful technologies and techniques for water resource management.

Table 1 Harvesting Regimes Plan.

Harvesting intensity	Location	Map grid reference
1	Lake Macdonald Dr	A1,B1,C1,D1,E1,A2,B2,C2,D2,E2,A3,B3,B4,B5, C4
2	"	C3,D3,E3,E4
3	"	F7
1	Hayward Rd	I13, I14, J13, J14
2	"	H12, I12
3	"	H9, I9 H10, I10

Table 2 Permanent diving transects

Transect No	Location	Map grid reference
1	Botanical gardens Boat ramp	A1
2		A1
3		A2
4	Ampitheatre	A3
5		A4
6		C4
7		C4
8	Air port	C3
9		C3
10	Scouts	E2
11		E2
12	Fish hatchery	D1
13	Hayward Rd	I13
14		I13
15		I12
16	Gumboil Rd	I9
17	Control	F6,7
18	Hayward Rd	I12
19	Scouts	F2
20	Airport	D5
21	Grange Rd	J12
22	Hayward Rd	G12
23	Gumboil Rd	I10
24	Hayward Rd	H12

Table 5. Project Workplan Projects 34506 and 34505 Cabomba L-ake Macdonald Catchment Care Group

Activity to be undertaken (details of methods used)	Who is responsible for this activity	Est. start date (mm/yy)	Est. finish date (mm/yy)
Form community based working group and commence monthly planning and information meetings	LMCCG, T Anderson, K Garraty	1/2001	On going
Finalise receipt of funding from Environment Australia	B Stockwell for LMCCG	11/2001	
Prepare an Environmental Recovery Plan for the management of cabomba	T Anderson K Garraty	11/2001	1/2002
All machinery purchased and operating	M Stahl	1/2001	On going
Commence harvester operator training	M Stahl, K Garraty NSC	12/2001	12/2004
Scientific review	Alan Fletcher Research Station Scientists	12/2001	6/2004
Monthly data collection of cabomba biomass	Abyss Diving, TAnderson, KGarraty	7/2001	7/2003
Video taping 20 permanent underwater transects on a monthly basis	Abyss Diving	7/2001	8/2003
Appoint project officers for component 1 and 2	LMCCG	1/2002	8/2003
Erect on-site information signage	K Garraty	2/2002	
Commence harvesting as per the Environmental Recovery Plan	M Stahl, K Garraty, T Anderson	1/2002	12/2003
Ensure harvester is operating effectively in priority areas	M Stahl, K Garraty, T Anderson	12/2002	9/2003
Collect water, plant and silt samples for laboratory assay.	Abyss Diving, TAnderson, KGarraty	7/2001 4/2002 10/2002 4/2003	
Constant review of the program by the Lake Macdonald Catchment Care Group	LMCCG	On going	On going
Invite local TV to cover the commencement of the project	NSC publicity officer	2/2002	2/2003
Evaluate aqua culture equipment and methods for nursery.	K Garraty, TAnderson	12/2001	
Nursery site selection	Noosa Disrict Landcare, T Anderson K Garraty	12/2001	
Establ;ish Hydrilla and vallisneria(native water grasses) nursery	Project Officer	1/2002	9/2003
Appoint plant propagator	LMCCG	1/2002	10/2003
Survey of the Six Mile Creek system for the collection of plant propagating material	Noosa District Landcare	1/2002	On going
Review and collation of data - reviewing the video sampling will take a great deal of time	Project Officer T Anderson K Garraty	3/2002	12/2003
Ensure harvester is operating effectively in priority areas	M Stahl, K Garraty, T Anderson	On going	
On site field day at nursery	K Garraty	4/2002	
Prepare media press release	NSC publicity officer	3/2002 9/2002 2/2003	
Habitat planting days, involving community and school groups	Project officer, LMCCG	3/2002 9/2002 2/2003	

Activity to be undertaken (details of methods used)	Who is responsible for this activity	Est. start date (mm/yy)	Est. finish date (mm/yy)
Invite local media	NSC publicity officer	3/2002 9/2002 2/2003	
Presentation at weed industry conferences. Eg. NSW 11th Weed Conference, Qld Weeds Symposium and South East Qld Pest Advisory Forum	T Anderson K Garraty	7/2002	7/2004
Constant review of the program by the Lake Macdonald Catchment Care Group	LMCCG	On going	
Enter monthly field records into a database	T Anderson K Garraty	On going	
Prepare progress report on a six monthly basis	T Anderson K Garraty, Project officer	6/2002 12/2002 6/2003 12/2003	
Write final report	T Anderson K Garraty, Project officer	12/2003	

T Anderson
Alan Fletcher Research Station

K Garraty
Noosa Council